

WEATHER AND CIRCULATION OF JUNE 1971

A Reversal of the Temperature Regime in Most of the United States

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1. MONTHLY MEAN CIRCULATION

Significant changes in average 700-mb flow were observed in June (figs. 1 and 2). This was in contrast to the persistence noted from April to May (Stark 1971). A considerable increase occurred in the 700-mb heights over the eastern half of the United States, where a 20-m positive height anomaly center (fig. 3) replaced the 30-m negative height anomaly center of May near the Great Lakes. The only area in the East with below-normal

heights was the extreme Southeast, and here the departures were less than 10 m below normal. Only in the Northwest were 700-mb heights lower in June than in May (fig. 2).

Very strong ridging was manifested across Greenland and the polar region this month (fig. 2). In fact, rising upper level heights prevailed from North Africa through the polar basin and into the tropical sections of the Pacific near the 180th meridian. The largest 700-mb height increases were more than 130 m near southern Greenland and over 120 m in the Baffin Island area.

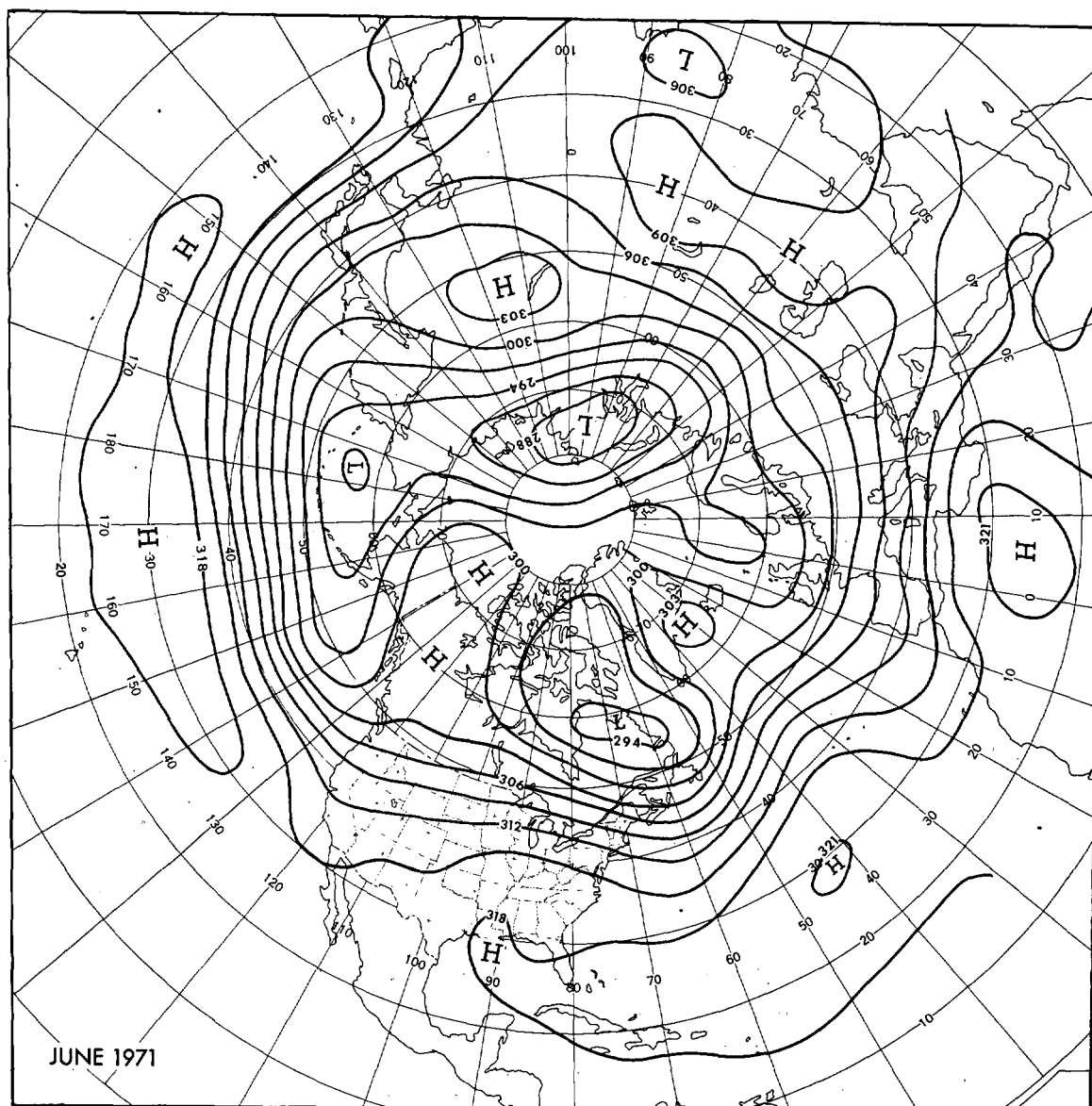


FIGURE 1.—Mean 700-mb contours (in dekameters) for June 1971.

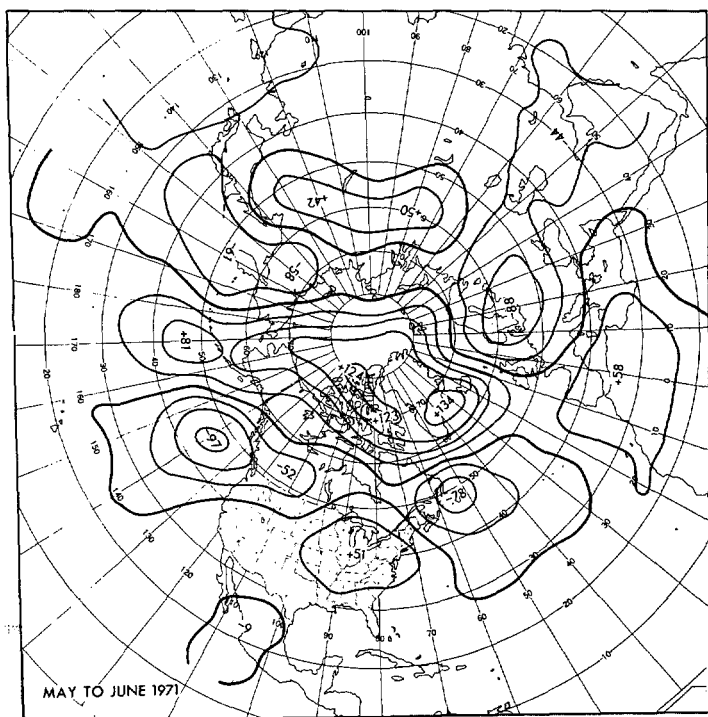


FIGURE 2.—Mean 700-mb height anomaly change (m) from May to June 1971.

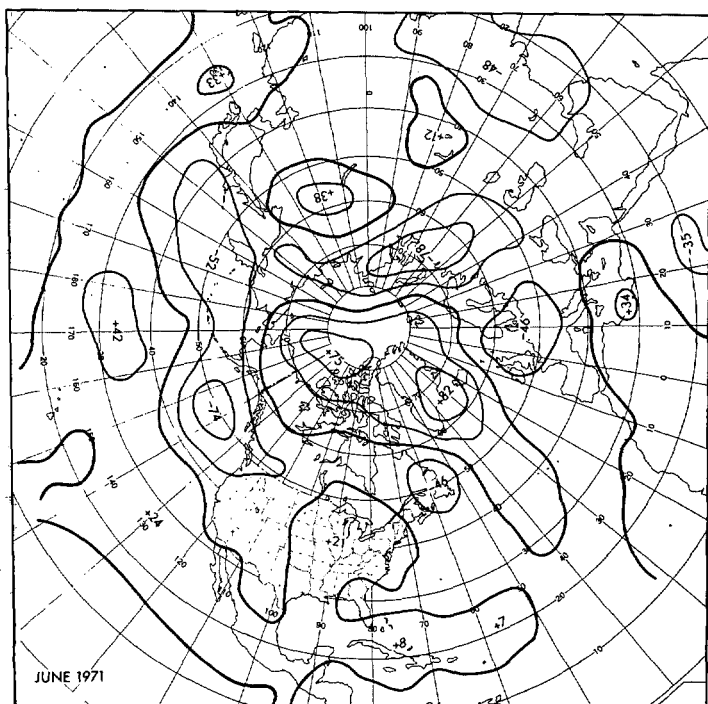


FIGURE 3.—Departure from normal of the mean 700-mb height (m) for June 1971.

Along either side of this elongated area of height increases and anticyclonic activity, concomitant areas of cyclogenesis and 700-mb height falls were observed.

During winter and spring seasons of the year, such an extensive area of 700-mb positive height anomaly in high latitudes as shown in figure 3 usually results in large meanderings in the major westerly wind belt; but the

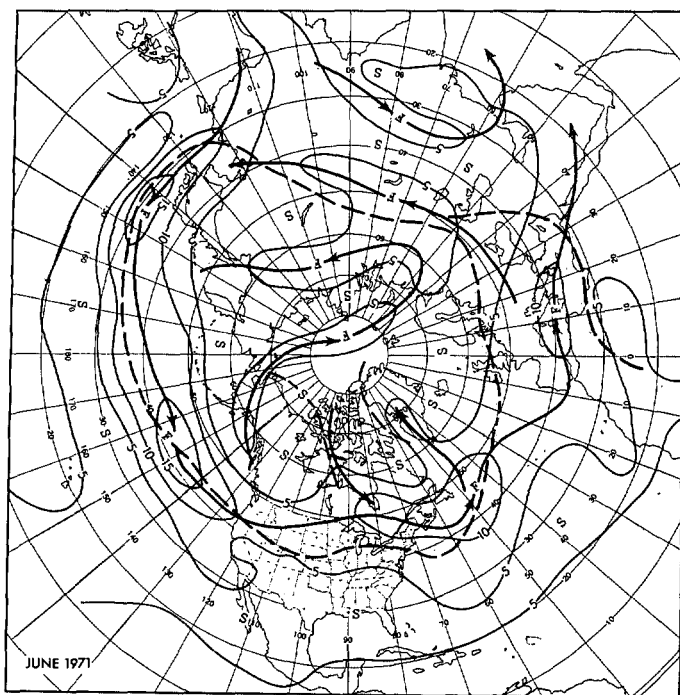


FIGURE 4.—Mean 700-mb isotachs (m/s) for June 1971. Solid arrows indicate the observed axes of maximum wind speed, and the dashed lines indicate the normal axes.

core of the faster westerly flow this June was little displaced from normal all across the Pacific and North America (fig. 4). However, in the eastern Atlantic the center of the stronger westerly wind band was more than 10 deg. south of normal.

Across Eurasia the 700-mb flow was rather complex with several branches of widely divergent flow. One branch passed north of the blocking High near Lake Baikal, while a second branch flowed south of this block toward Korea. A third branch of winds was an easterly flow near the Himalayan Mountains. A fairly strong band of winds that is usually over North Africa in June was over the Mediterranean Sea this month.

2. MONTHLY TEMPERATURE

The decreasing cyclonic activity and rising 700-mb heights (fig. 2) that occurred over much of the conterminous United States were accompanied by rising temperature. The majority of the Nation reported above-normal monthly temperatures (fig. 5) in contrast to the coolness of May. But, the upper level trough near the west coast (fig. 1) resulted in an almost continuous incursion of cool Pacific air into the Northwest that caused the temperature in the area to remain well below normal most of the month. Very few temperature records were established during this month, and most of those that were reported were either daily maximum or minimum extremes.

Several stations in the warmer part of the country, including Cairo and Rockford, Ill., and Green Bay, Wis., reported near record warmth. Truax Field at Madison, Wis., with an average temperature 5.6°F above normal,

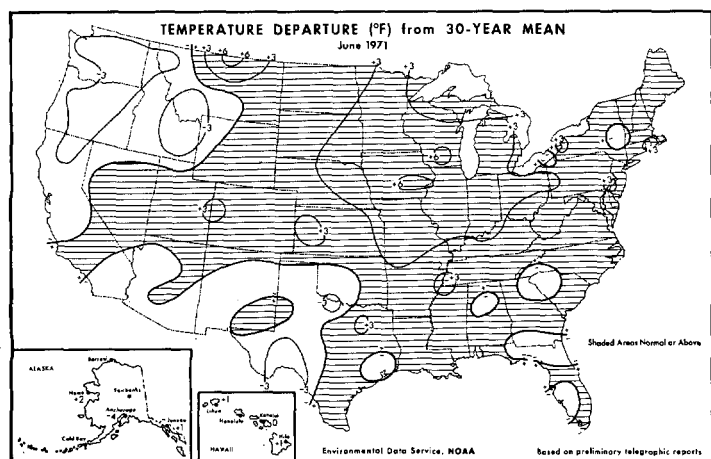


FIGURE 5.—Departure from normal of average surface temperature (°F) for June 1971 (from Environmental Data Service and Statistical Reporting Service 1971).

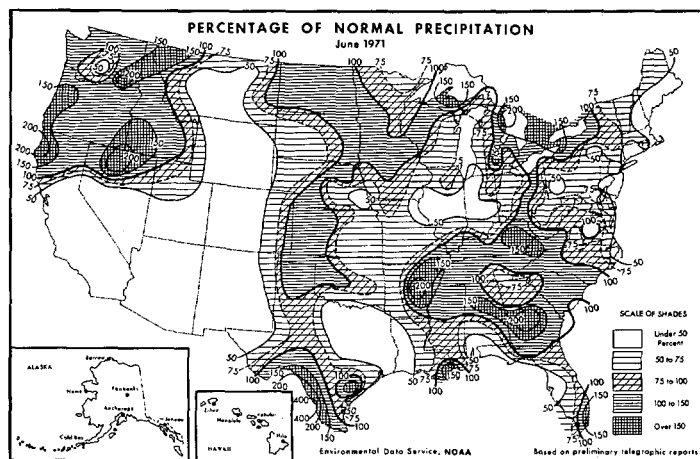


FIGURE 6.—Percentage of normal precipitation for June 1971 (from Environmental Data Service and Statistical Reporting Service 1971).

reported the warmest June of record. Many remarks on the climatological reports received from stations in the warmer part of the country this month compared the warmth of this June to either the 1933–34 period or the 1953–54 period.

Record cool weather with temperatures that averaged 4.3°F below normal was reported at Olympia, Wash., where daily maxima, under the influence of cloudy skies and above-normal precipitation, averaged 7°F below normal. Salem, Oreg., reported a 58.2°F average that was the lowest for June since 1953 and 1954, the same period that some of the warmer stations in the eastern half of the country had found analogous. Red Bluff, Calif., another unusually cool station this month, reported that temperatures reached 90°F or higher on only one day prior to June 11. This was only the third time since 1877 that the maxima were “so cool so late in the year.” The two previous similar years were 1948 and 1953.

The below-normal temperatures in the Southwest were less intense and persistent than in the Northwest, but here also, the anomalously low temperatures were associated with cloudiness and precipitation. Del Rio, Tex., where the temperature averaged 4.3°F below normal, recorded more than twice normal rainfall and an average 0.8 sky cover from sunrise to sunset.

3. MONTHLY PRECIPITATION

Most sections of the United States outside the Southwest and Southern Rocky Mountains received 2 to 4 in. of precipitation in June, and some of the drought areas received relief (fig. 6). Typical summer thunderstorms and showers were the major types of precipitation. Some thunderstorms had large hail, strong winds, torrential rains, and tornadoes associated with them. Severe weather occurred mostly in the central and southeastern parts of the Nation.

In Florida, where drought had been serious during the late winter and early spring, 4 to 6 in. of rain fell over most of the State. This rain, following above-normal

rainfall in many sections of the State in May, has alleviated much of the drought. Yet, Fort Myers reported the 13th consecutive month with below-normal rainfall. From June 1, 1970 through June 1971, 40.94 in. of precipitation were recorded at Fort Myers, compared to a normal 60.30 in. for that period. The Tampa area and the western panhandle of Florida were still relatively dry this month with less than half of the normal rainfall (fig. 6).

Large areas of Texas remain in severe drought conditions. Most of northeast Texas reported less than half of the normal rainfall in June, and only a relatively small area in the State had more than normal rainfall. The Del Rio area and other sections along the Rio Grande received 4 to 8 in. of rain, which ended drought conditions in those areas for the present.

Normally dry Arizona and New Mexico continued drier than usual in June. In Arizona, Phoenix reported the 9th month of below-normal precipitation and Flagstaff had its 6th rainless June since 1894. Albuquerque, N. Mex., with only 0.02 in. during June, reported less than 50 percent of its normal precipitation since the first of the year. Roswell, N. Mex., has had only 3.50 in. of precipitation in the last 11 mo.

Dry conditions spread northward this month in the Rocky Mountain area. Lander, Wyo., with only a trace of rain, tied the all time June record set in 1956; while Sheridan, Wyo., reported the second driest June since 1907 (the driest was in 1933). Great Falls, Mont., also reported the second driest June of record, and Helena, Mont., reported less than half of its normal 2.23 in.

The precipitation patterns in general were quite well related to the observed mean flow (figs. 1 and 3). The stronger than normal eastern United States ridge forced warm moist tropical air well northward through the Country east of the Rockies, with the usual air mass or frontal showers and thunderstorm activity. The band of above-normal precipitation from the Texas panhandle through Kansas and northward into Canada (fig. 6) was closely related to the anomalous southerly gradient at the 700-mb level in that area (fig. 3), and the heavier than

normal rainfall in the Southeast was associated with the anomalous easterly flow in the middle troposphere in that section. The heavy precipitation in the Northwest was caused by the proximity of the west coast trough and the anomalously strong southwesterly maritime flow being lifted over the mountainous terrain. The dryness in Montana and Wyoming was a "rain shadow" effect of the southwesterly flow across the Rocky Mountains.

4. VARIABILITY WITHIN THE MONTH

A definite break from the May weather regime in the United States began during the first week of June. Strong upper level ridging was evidenced in the East with a mean trough persisting in the West (fig. 7A). Temperatures rose rapidly in most areas east of the Rocky Mountains, reaching 6°F or more above normal in parts of several states (fig. 7B). Temperatures in the region where the largest change was reported, including Kansas, Iowa, Missouri, and the Ohio Valley, averaged 16°F higher in the May 31–June 6 week than during the previous week. The mean trough over the West was accompanied by generally below-normal temperatures.

Most of the precipitation in the eastern half of the Nation was air mass showers, since frontal activity was weakening as the warm moist air spread northward (fig. 7C). Late in the week, rather strong thundershowers and some tornadoes occurred in the plains along the boundary between the eastern warmth and the western coolness. At Hastings, Nebr., hail as large as golf balls and wind gusts to 81 mi/hr were observed. Some localities reported hail as large as baseballs this week. The precipitation in the Northwest was related to the mean upper level trough in that section.

The longwave trough in the West weakened during the second week of June, as a short wave moved northeastward through the Northern Great Plains (fig. 8A). The eastern mean ridge remained fairly strong in the north but weakened somewhat in the Southeast. With the advance of the shortwave trough out of the West, temperatures decreased in the Ohio Valley and the Central Plains but still remained mostly above normal in the weekly average (fig. 8B). Temperatures rose in much of the west as the longwave trough weakened, but a sizable area in the Southwest and Northwest had temperatures below normal. Again this week, showers and thunderstorms were frequent and widespread in the warm moist air (fig. 8C). Thunderstorms were especially severe in parts of the Great Plains. Slightly more than 2 in. of rain fell in 2 hr at North Platte, Nebr., and 3.23 in. was recorded at Pierre, S. Dak., in 6 hr.

The mean trough that had been in the Southwest retrograded to the Pacific coast during the third week of June, while the eastern ridge weakened somewhat more in the South but remained about constant over the Northeast (fig. 9A). Temperatures rose in response to this circulation change in the Southwest and some of the Central States (fig. 9B). The effect of the falling 700-mb heights in the Southeast, while the ridge to the north held strong, was to cool the Middle Atlantic States with

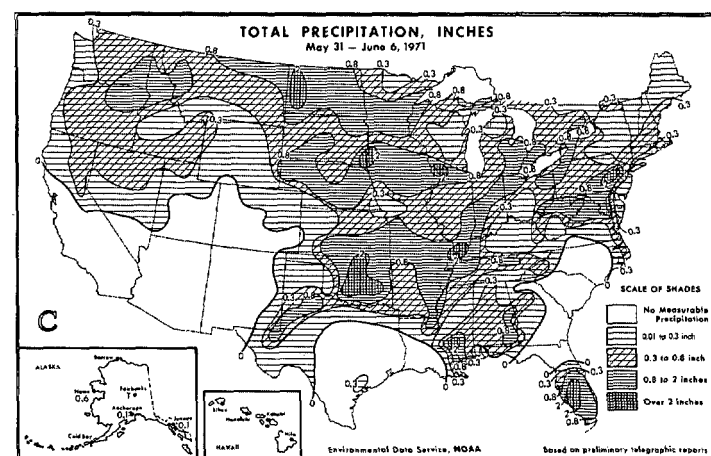
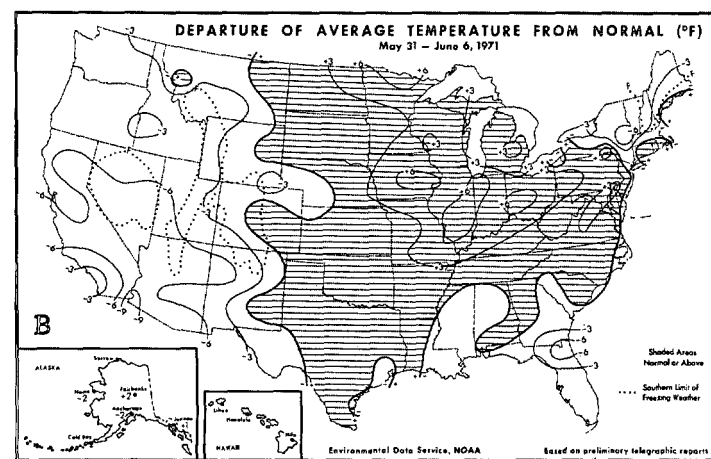
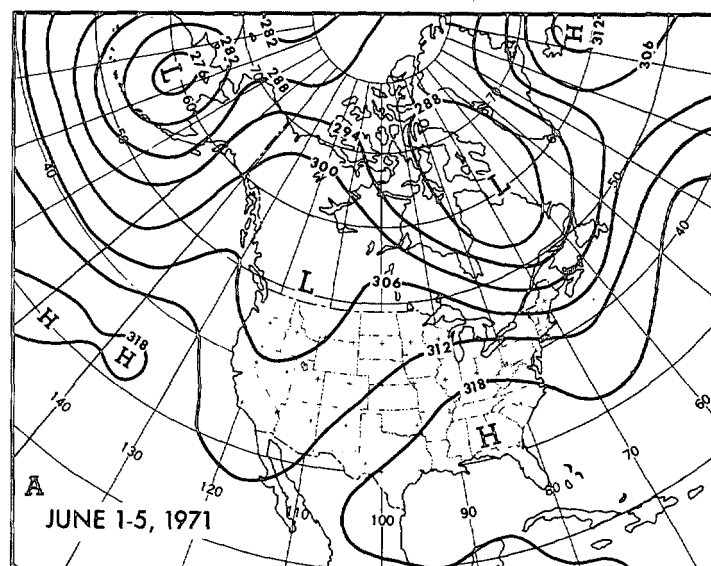


FIGURE 7.—(A) mean 700-mb contours (dam) for June 1–5, 1971; (B) departure of average surface temperature from normal (°F) and (C) total precipitation (in.) for week of May 31–June 6, 1971 (from Environmental Data Service and Statistical Reporting Service 1971).

an influx of mild Atlantic air. The western half of the Nation was noticeably drier with the retrogression of the Southwest trough (fig. 9C). The heaviest precipitation this week fell in the Tennessee Valley and in the Southeast along the boundary between the cool Atlantic air and the moist hot tropical air.

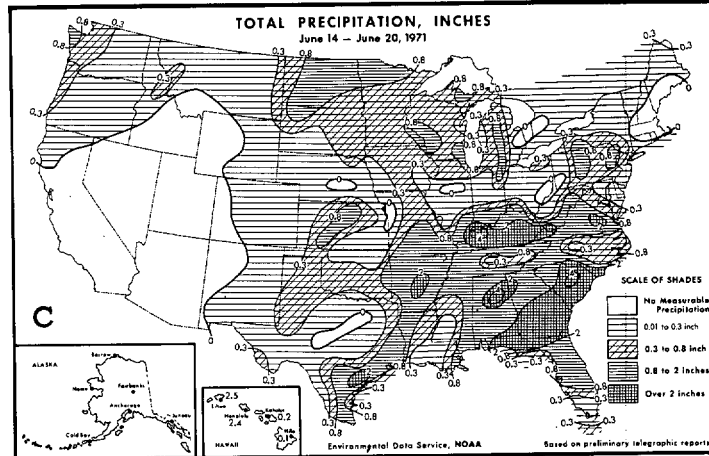
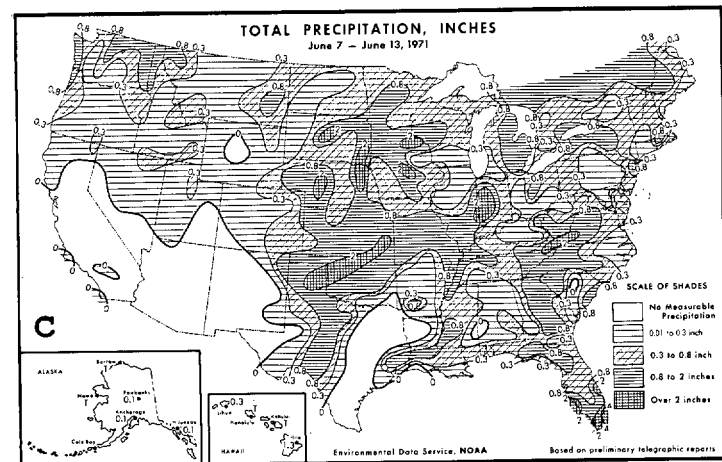
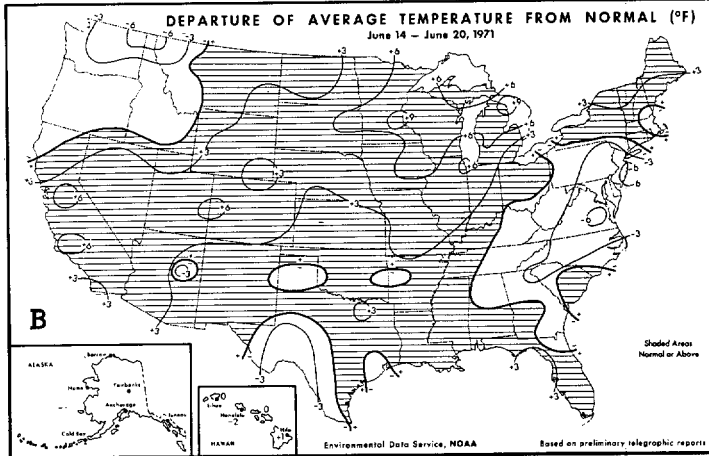
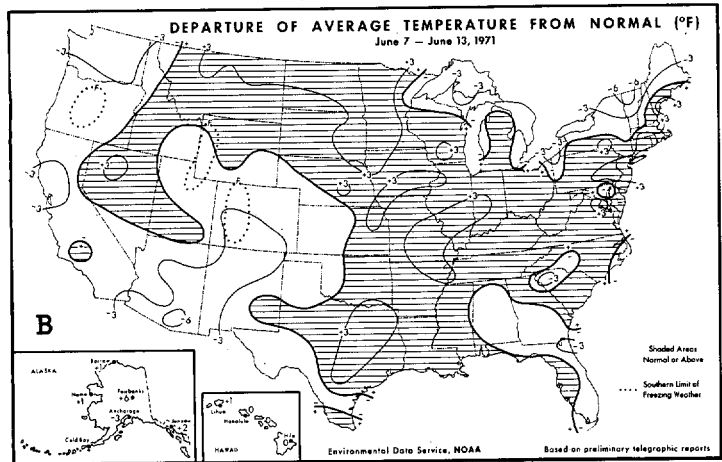
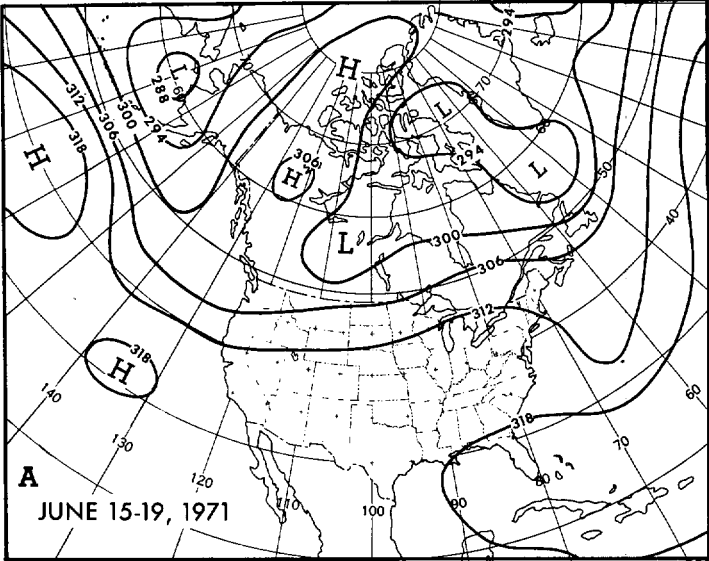
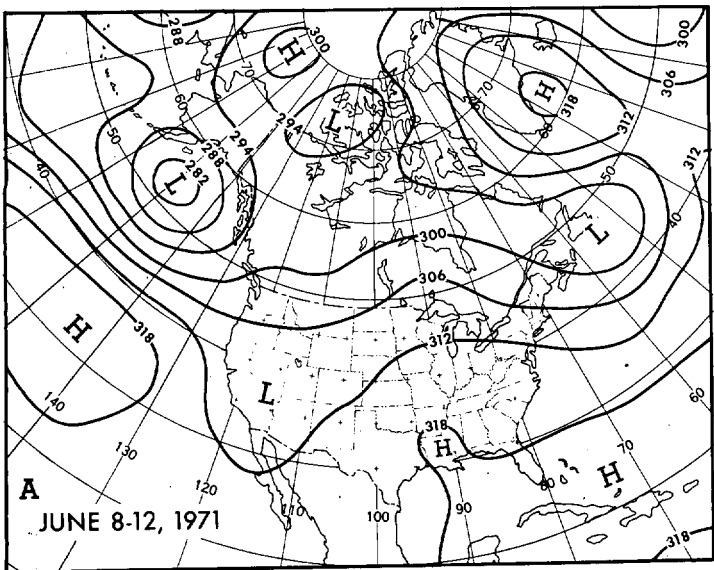


FIGURE 8.—Same as figure 7, (A) for June 8-12, 1971; (B) and (C) for week of June 7-13, 1971.

FIGURE 9.—Same as figure 7, (A) for June 15-19, 1971; (B) and (C) for week of June 14-20, 1971.

Along with rising temperatures in the Central and Northern Great Plains the eastern ridge moved westward during the week of June 21-27 (figs. 10A and 10B). The Middle Atlantic States warmed also under the effects of a more continental flow brought about by the upper level ridge centered in the central part of the Nation. Cooling was evident near the Great Lakes as a result of cool air

deployed through that area by the strong blocking ridge north of Alaska. The below-normal temperatures in the Southeast and the Texas area were mostly the result of cloudiness and rain, while the northwestern coolness, as in the previous week, was associated with the proximity of the western trough. The majority of the precipitation that fell this week across the United States was associated

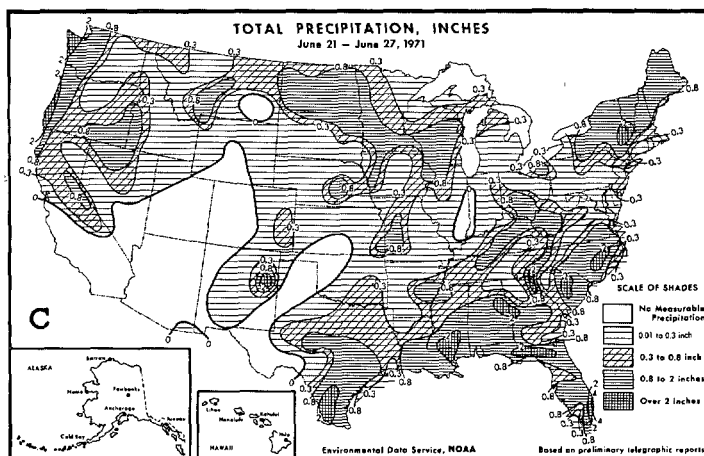
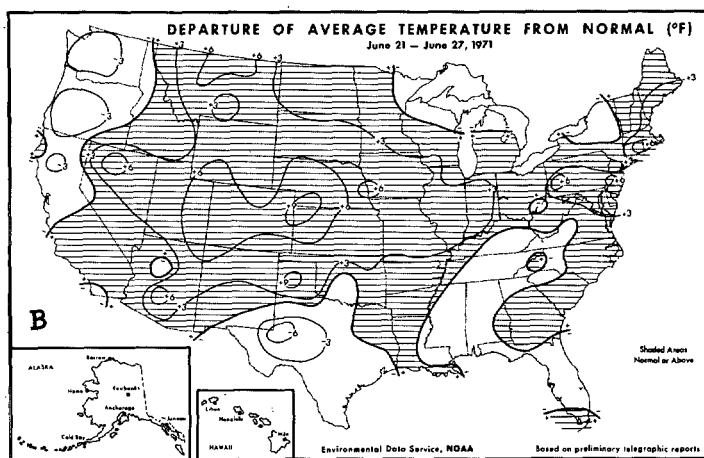
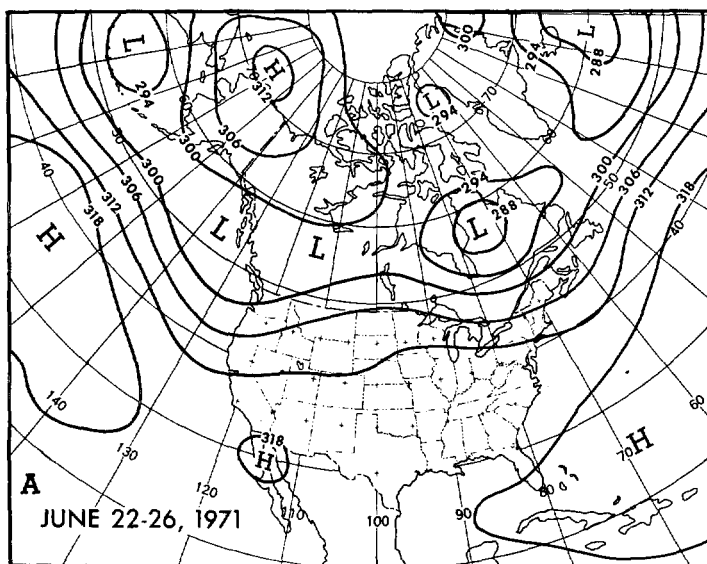


FIGURE 10.—Same as figure 7, (A) for June 22-26, 1971; (B) and (C) for week of June 21-27, 1971.

with fronts (fig. 10C). The main exception was the northwestern precipitation which was more directly associated with cyclonic activity in the mean trough area.

During the last few days of June, the mean upper ridge over the United States returned to the east, and the long-wave trough remained off the west coast. A short-wave

trough advancing through the plains spread quite cool air eastward over much of the Great Plains, while the Great Lakes area warmed. Heavy rain fell in the Great Plains as the trough advanced, and the West dried. No reports of precipitation were received June 30 from major NWS stations west of the Rocky Mountains. A "backdoor" cold front associated with the advancing eastern ridge cooled most of the Eastern Seaboard the final days of June and contributed to heavy rainfall in the Southeast.

5. ALASKAN AND HAWAIIAN WEATHER

The majority of Alaska was drier than normal in June, reflecting the influence of the strong ridge to its east and anomalous easterly flow (figs. 1 and 3). The only section to have near-or above-normal rainfall was the Alaskan and Kenai Peninsulas and nearby islands. Cold Bay, with a total of 6.67 in., more than twice the normal amount, received the most rainfall. Fairbanks reported the lowest percentage of normal June rainfall in Alaska, receiving only 0.31 in. compared to a normal 1.39 in.

The area of above-normal temperatures in Alaska corresponded closely to the area with above-normal 700-mb heights (fig. 3). All of the southern coastal area and southeast Alaska except the Juneau area reported below-normal monthly temperatures. Apparently the effect of the easterly anomalous flow along with the mountain range to the east kept Juneau's temperature slightly above normal. The Alaskan area that reported the greatest departure below normal included St. Paul Island, Cold Bay, King Salmon, and Anchorage. All of these stations averaged more than 4°F below normal. The warmest station in Alaska, in both the absolute and anomalous sense, was Fairbanks with an average temperature of 63.4°F, 5°F above normal.

The 700-mb flow and heights in the Hawaiian area were close to normal in June. The surface temperatures seemed to reflect this. Lihue, with 1.3°F above normal, was the only station to report as much as a 1°F departure from normal. However, the small variations from normal observed in the mean circulation (fig. 3) caused an anomalous precipitation pattern. Hilo received less than half the normal 6.79 in., and indirect reports indicate that most of the eastern portions of the two largest islands were significantly drier than normal. In contrast, Honolulu reported 2.48 in. which was 2.13 in. above normal. Lihue also reported much above-normal rainfall.

REFERENCES

- Environmental Data Service, NOAA, U.S. Department of Commerce, and Statistical Reporting Service, U.S. Department of Agriculture, *Weekly Weather and Crop Bulletin* Vol. 58, Nos. 23-27, June 7, 14, 21, 28, and July 5, 1971.
- Stark, L. P., "Weather and Circulation of May 1971—Persistent Cool, Wet Weather Associated With Blocking Over North America," *Monthly Weather Review*, Vol. 99, No. 8, Aug. 1971, pp. 654-658.